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ABSTRACT

This paper discusses implications of assistive technology for teachers or early intervention professionals who are seeking to optimize the educational experiences of children with disabilities. The paper considers the role of the Federal Government in Public Law 100-407, which establishes a grant program for statewide delivery of assistive technology, and examines implications for state technology planning. It then describes Technology Access for Arkansans, a project which conducted a statewide needs assessment of the technology and related services needs of 206 infants and young children (0-5 years) with disabilities. The needs assessment determined levels of satisfaction, expenditures for assistive technology, travel practices to acquire assistive devices, and funding sources. Issue areas emerging from the needs assessment included computer technology, centralized information, decentralized services, expanding the usage of existing funding options, hands-on experience with devices prior to payment, and transportation. Implications for teachers and early intervention professionals include their changing roles concerning assessment, acquisition, and use of assistive devices. These new roles require recognition of ethical issues, use of a team approach, and matching the technology with the individual. The paper concludes with specific suggestions for delivering assistive technology services. (Includes 58 references.) (JDD)

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Early Childhood Special Education, P.L. 100-407, and Assistive Technology

Strategies and Implications for the Classroom Practitioner

Presenter:

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Paper presented to the
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Early Childhood Special Education, P.L. 100-407, and Assistive Technology: Strategies and Implications for the Classroom Practitioner

There has been a tremendous increase in the use of assistive technology in our society, and it is unequivocal that the continuum of technologies available has dramatically impacted upon the quality of life for all persons. Assistive technologies are not only the tools of the future, but are increasingly important compensatory and instructional implements of today. For persons with disabilities, particularly infants and young children, the promise of technology holds exciting possibilities (Cain & Taber, 1987; Goldenberg, Russell, & Carter, 1984; Kinney & Blackhurst, 1987), providing options that enable even the most seriously impaired children maximum opportunities to participate fully in the mainstream of our society (Cavalier, 1988; Green & Long, 1980).

The term assistive technology has been defined in various ways by professionals across the education and rehabilitation disciplines. For example, one recent definition offered by Reynolds and Mann (1987), suggested that assistive technology was applicable to a wide range of highly specialized mechanical, electronic, and computerized tools which are commonly used in both rehabilitation and special education settings. Generally, such technologies are designed to perform specific orthotic or prosthetic functions, though they are not prostheses or orthotics in the traditional sense. Such a definition, then, would include positioning and mobility devices, augmentative communication aids, computer applications, adaptive toys and games, electronic interfaces, and adaptive environments (Brady, 1988; Garner & Campbell, 1987; Hofmeister & Friedman, 1986).

Assistive technology has been demonstrated to enhance both the educational functioning and living independence of persons having a wide range of disabilities such as visual and hearing impairments, communication and movement

disorders (Bigge, 1982; Enders, 1984). When assistive technology is applied to a particular child, it is typically with two major purposes in mind: (a) to correct or remediate a specific impairment; and (b) to assist a child to learn specific material and/or to learn specific tasks (Garner & Campbell, 1987).

For infants and young children who have disabilities, the availability of needed assistive technology can often enable the child to overcome obstacles that might otherwise be encountered during the child's interactions with the environment (Behrmann & Lahm, 1983; Fewell, 1983; Langley, 1983). Similarly, the acquisition of developmental skills, as well as the facilitation and automation of therapeutic activities have been shown to result from the use of assistive technology across a number of learning settings (Vanderheiden, 1985).

Role of the Federal Government

The most important federal mandate which recognizes the importance of technology and technology-related assistance to children with disabilities is P.L. 100-407. This important law expands the availability of assistive technology services and devices to persons with disabilities of all ages through the development of a discretionary grant program. The purpose of the law is twofold: 1) to establish a grant program that would assist states in developing and implementing a statewide program for the delivery of assistive technology; and 2) to involve the federal government in the delivery of assistive technology.

Under Title I, the Secretary of Education will make awards to states through a competitive grants program to develop model consumer-responsive statewide systems of technology-related assistance for persons of all ages with disabilities. States may also use funds to fund assistive technology and services for young children with disabilities, an option which several states have already implemented under the new legislation (RESNA, 1989).

The IFSP, IEP, and Assistive Technology

The recognition by the federal government of the importance of technology has recently been echoed in the passage of Public Law 101-476, the*Individuals with Disabilities Education Amendments of 1990,* which amended the Education of the Handicapped Act while reauthorizing its discretionary programs for five years. This new legislation defines assistive technology devices for the first time, using a broad interpretation consistent with previous legislation (P.L. 100-407). As defined in P.L. 101-476, an assistive technology device is any equipment used to increase, maintain, or improve the capabilities of disabled individuals.

Assistive technology services are also now defined in the new legislation. They include: (a) evaluating persons with disabilities; (b) acquiring assistive technology services; (c) selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing assistive technology devices; (d) using therapies with assistive technology devices; and (e) training for individuals who provide services for persons with disabilities.

Whereas technology could at one time be provided as a related service under P.L. 94-142, it can now be specifically provided as a defined service. Similarly, the Early Education for Children component of P.L. 101-476 authorizes new priority areas, which includes the promotion of the use of assistive technology. Hence, IFSPs must now include the provision of technologies appropriate to meet the needs of young children and families.

Implications for State Technology Planning

As states begin to examine how their systems of technology service provision for infants and young children with disabilities can be enhanced, particularly in light of increased funding patterns for assistive devices (RESNA, 1989), greater involvement in the processes of P.L. 100-407 may be anticipated. It is specified that one of the activities which states may use funds for under this act is to carry out a

statewide needs assessment to obtain information on the scope and types of services to be provided. Under this needs assessment, states are also required to examine existing funding sources available for the payment of assistive technology.

Response from the State of Arkansas

Prior to the enactment of P.L. 100-407, a group of persons representing six public and private agencies in Arkansas developed a grant proposal focusing on the technology needs of persons with disabilities. The resulting project, Technology Access for Arkansans (TAARK), was designed to: (a) identify the need and quality of technology provisions in Arkansas; (b) to disseminate information about the appropriate technology and funding; (c) to educate Arkansans about technology and funding; (d) to educate Arkansans about technology and advocacy; (e) to develop a coordinated state plan; and (f) to provide technical assistance to the Governor's Developmental Disabilities Planning Council (DDPC). The project was funded in part through the DDPC and in part through the University of Arkansas-University Affiliated Program. Soon after this project was funded at the state level, the federal technology legislation was enacted in August of 1988 providing the impetus to develop a broad state plan addressing the technology needs of persons with disabilities, as well as to develop an application for federal funding under P. L. 100-407.

An important concern of many persons involved in the state technology planning activities coordinated by the TAARK project was the needs of young children with disabilities. It was suspected from the outset that some funding mechanisms for technology were used with less frequency than others. Similarly, the fragmented nature of the service delivery system in the state suggested that other technology service delivery options were inadequate to meet the needs of young children with disabilities. Additionally, there were many concerns which related to

the design of a comprehensive system of technology-related assistance for young children with disabilities, as well as other age groups.

A statewide needs assessment was conducted during the P. L. 100-407 grant application processes focusing on the technology needs and related services of a sample of infants and young children with disabilities in Arkansas. The results were used to clarify questions which could be addressed in state technology planning processes. The study identified areas of technology-related service provision that might potentially be of concern to policy-makers in Arkansas and other states.

Survey Results of Infants and Young Children With Disabilities

A total of 206 children ages 0-5 years were surveyed in the needs assessment. Reports of disability category provided by the parents, guardians, or primary caregivers of the children participating in the survey reflected a wide range of disabilities.

Levels of satisfaction. Respondents were asked to report whether or not they used assistive devices/services in 15 areas as reflected in Table 1. They were also asked to indicate whether or not they had an unmet need for assistive devices/services in these respective areas. Technology usage was reported in all areas of life functioning for the respondents ages 0-5 participating in the survey. As noted in Table 1, the areas in which technology was most often used as reported by the parents or primary caregivers were *recreation* (35%), followed by *self-help* (34%), *getting around* (32%), and *school training* (25%). Unmet needs were also reported in all areas of life functioning. In some of these unmet needs categories (*taking care of the home; talking with others; reading, writing, and typing; things that help you see; building accessibility;* and *specialized cars, vans, and buses*) parents or primary caregivers reported unmet needs more often than usage. In two categories, *using a computer* and *using a telephone,* there was a substantial discrepancy between the percentage of respondents using technology in these areas and those having unmet

needs. The number of children having unmet needs in using a computer was almost 8 times that of those actually using computer technology. The number of children having unmet needs in using a telephone was more than 5 times that of those who use telephone technology.

Insert Table 1 about here

Expenditures for assistive technology. Parents and primary caregivers were asked to report their expenditures for devices, services, and/or maintenance of technology in 1988. As noted in Figure 1, it was reported for a majority of respondents (30%) that less than $100 for technology devices and services was expended. Expenditures of between $100 and $500 were reported for 10% of the respondents. Larger expenditures for technology in the range of $501-$1000 were reported for 14% of the respondents, and for 17% personal costs of $1001-$5000 were reported. Expenditures for technology exceeding $5,000 in 1988 were reported for only 4% of the participants. For a substantial number of survey respondents (25%), no knowledge of personal expenditures for devices/services/ maintenance in 1988 was reported.

Insert Figure 1 about here

Travel practices. Regarding travel practices pertaining to assistive technology and services, participants were asked: *How far did you have to travel to get the assistive devices/services that you receive?* As noted in Figure 2, it was reported for 11% of the respondents that no travel was involved in order to receive assistive devices/services. For another group of respondents (26%), traveling of only 1-20 miles was reported to receive their assistive devices/services. It was reported for 10% of the participants that they had to travel 21-50 miles to receive such services. Reports for a large number of respondents (22%) indicated having to travel over 50 miles to receive assistive devices/services, with reports for 31% indicating that travel

in excess of 100 miles was required in order to receive assistive devices/services that were needed.

Insert Figure 2 about here

Funding sources. Funding sources for assistive devices/services which were reported for those respondents participating in the survey included a wide range of mechanisms, though several funding sources appeared to predominate usage by young children with disabilities. The three most frequently used mechanisms for funding assistive devices/services reported were Medicaid (44%), the family (36%), and private insurance companies (28%). Interestingly, it was reported for only 2% of the respondents that assistive technology was provided through the public school systems.

Levels of satisfaction. Although survey forms were completed for 206 respondents, many of the forms were incomplete in which persons failed to answer questions regarding levels of satisfaction with technology and related services. Table 2 reflects levels of satisfaction reported for respondents in a number of issue areas.

It was reported for a majority of respondents (83%) that they participated in an assessment or evaluation prior to obtaining their assistive devices/services. It was reported for a comparable number of respondents (83%) that they were satisfied with the services they received for their assistive devices. However, for 69% of the respondents, it was reported that *more information was needed* regarding assistive devices/services. This need for information was supported by the high number of unmet needs reported in all categories of assistive devices/services (see Table 1).

Insert Table 2 about here

In the area of equipment purchasing practices, Table 2 reflects that it was reported for only 20% of the respondents that an opportunity to purchase assistive

devices on a "buy-on-time", or credit plan was made available, while for 63% of the participants it was reported that such a plan would be helpful to assist them in purchasing needed devices. For a large number of respondents (37%), it was reported that they did not receive adequate training in the use of their devices. It was also reported for 62% of the participants that they did not have an opportunity to try out devices before being required to pay for them. For a substantial number of respondents (40%), dissatisfaction was expressed with the length of time required for the servicing of their devices when they were in need of repair.

Transportation services. Participants were asked the question, *"Are transportation services being provided to you?"* It was reported for the majority of the infants and young children (70%) that no services were currently being provided.

Discussion

One of the many strengths of the Arkansas approach to state technology planning *was the consumer survey,* which was unique among the first 9 state applications to receive funding under P.L. 100-407. As such, the approach has value that should be given consideration by other states participating in state technology planning. It also has implications for classroom practitioners that may be assisting in the development of proposals or in implementation of state systems.

Perhaps the greatest benefit of the study was the identification of unmet need categories. Examining the frequency of unmet technology needs in varying areas of life functioning reported for participants in the survey suggests that there may be significant numbers of young children having disabilities who are being inadequately served by agencies within the service delivery system in the State of Arkansas. Similar needs have been reported by states receiving initial funding under P. L. 100-407 (RESNA, 1989). Several issue areas emerge from the data that should be given consideration by professionals.

Computer technology. Given the fact that states have only been recently mandated to provide educational services to infants and preschoolers through the

public school systems, it would be expected that computer technology would not be widely used with this population as yet. Technology needs data from a survey of a large sample of professionals in Arkansas (Division of Rehabilitation Services, 1989) have indicated that professionals generally express deficits in their college preparatory training. It is reasonable to assume that if colleges and universities are currently reporting needs in this area, that teachers and other rehabilitation professionals in the field have inadequate skills and are themselves failing to apply existing technologies to this new service population. The low incidence of technology funding via the public schools and other state agencies as reported for the survey respondents in the Arkansas sample of infants and young children seems to support this observation.

It cannot be argued that great strides have been made in the use of computer technology in the public schools, particularly in the domains of microcomputer applications and electronic assistive instruction (Hagen, 1984; Office of Technology Assessment, 1988; Rheingold, 1986; Taber, 1982). But reports of needs for training in computer technology and its applications to persons with disabilities are reported by other professionals in the rehabilitation fields as well (Anson & Kanny, 1989; Division of Rehabilitation Services, 1989; Leneway & Montgomery, 1981; Nave, Browning, & Carter, 1983) These needs have been clearly implied in the language of federal legislation.

Variability in responses to existing legislation through the use of funding streams is somewhat disappointing given what is known about the potential of microcomputer applications to significantly impact upon the quality of life for children with disabilities. For example, it is known that microcomputer applications are possible in virtually all areas of human functioning in the environment, and are required to operate many of the newer technologies (Cain & Taber, 1987; Kinney & Blackhurst, 1987). But it may be that resource constraints are the greatest determinant of the extent to which computer technologies are widely funded through existing

federal legislation. Such resource constraints seem to be inherent in the implementation of P.L. 94-142 and P.L. 99-457 (Harbin, 1988; Mendelsohn, 1989). In fact, resistance to the widescale administrative commitment of available funds to purchase microcomputer technologies for infants and young children may be observable for some time to come (Mendelsohn, 1989; Office of Technology Assessment, 1988).

In the sample of Arkansas participants in the statewide needs assessment described previously, it was indicated that a large percentage of infants and young children had unmet needs in the area of computer technology. Whether or not these were *real needs* as opposed an *interest in the technology* is unknown. The potential for research in this area has not been a topic of systematic scientific inquiry, and remains a domain which should be examined more closely by professionals.

Centralized information. The finding in the herein described exploratory study lends support to the need expressed by many states that a centralized information system is of critical importance (Governor's Task Force on Technology and Disabilities, 1987; Hofmann, 1990; Issue Team on Technology and Person with Disabilities, 1986; RESNA, 1989). There are thousands of systems, *e.g.*, databases, networks, bulletin boards, that contain information relevant to persons with disabilities. However, parents of young children with disabilities, as well as many professionals involved in service delivery to this population, are unfamiliar with these sources for information and often do not know where to begin to look for needed services or assistance (Governor's Task Force on Technology and Disabilities, 1987; RESNA, 1989). In the Arkansas sample, the data suggested that there were needs expressed for more information in all areas of human functioning identified in the study instrument (see Table 1). Other states have voiced similar needs for information availability on the increasing volume of assistive devices and products (RESNA, 1989).

It has been suggested that such centralized information systems reflect certain characteristics to make them fully accessible to parents and professionals involved in service delivery to infants and young children with disabilities (Governor's Task Force on Technology and Disabilities, 1987; RESNA, 1989). For a younger population, important components would include:

1. The system must provide information relating to young children with a wide range of disability types and their families. This will enable relevant information regarding this population and their technology needs to be obtained by as wide an audience as possible.

2. The system should be accessible to all persons, regardless of their level of technological expertise, degree of disability, or availability of equipment. The system should also allow for multiple levels of entry as well as a variety of entry points into the information system.

3. The system should facilitate interactive communication among users, with information flowing both from the periphery to the center, and from the center outward. Parents, professionals and others involved in service delivery to younger children with disabilities would be able to exchange information, such as experiences in using specific types of technology with children having specific technology needs.

4. State-of-the-art technology must be employed in the design and operation of the system database. This must include the use of a comprehensive and dynamic database that will entail ongoing maintenance, support, and enhancement. Such a database would include information regarding where services for infants and young children and their families can be obtained, what technologies are available, and what funding resources are available for assistive technology.

5. The system must have some accountability or quality control component, enabling parents or service providers to input information regarding satisfaction with services received for infants and young children having disabilities. It should also

track usage of the system by children and their families, and allow for suggestions to be made regarding improvements in the system.

6. The system must have the commitment of a centralized management structure responsible for design, development, implementation, and on-going maintenance and support. Whatever agency is charged with the role of managing the information system should have the requisite software, hardware, and management expertise to support a complex system. In addition, the entity must have the required resources to to engage in public awareness activities.

7. The system must have the capacity to connect existing databases of information relating to infants and young children with disabilities. This will prevent those involved with maintaining the system, as well as those accessing it, from having to recompile existing information and maximize the utilization of available resources. This might entail the sharing of common information bases across a multitude of state and private agencies.

8. The system should enable children, their families, and professionals multiple levels of access. This assumes that geographic boundaries would not hinder access and that many levels of complexity would characterize the information base.

9. The system should be designed with a security component, facilitating access by only those who wish to use it for legitimate purposes.

Problems inherent in such sophisticated systems have yet to be fully understood given the infant stage of development characterizing the design and implementation of state technology systems. However, as experiences with and evaluations of such systems among the states emerge with the passage of time, it is anticipated that a great body of data will be compiled in the years ahead relating to centralized information systems. As this database expands, qualitative changes may be anticipated in the quality of information services provided to persons involved in the delivery of services to infants and young children with disabilities.

Decentralization of services. It has been suggested that, in light of resource constraints expressed by the service delivery system (Barnett, 1988; Smith & Strain, 1988), there is a trend toward more centralized support programs to provide needed information, expertise, and resources accessible to young children with disabilities (Elting, 1987). However, the language of P.L. 100-407 very clearly emphasizes the creation of "consumer-driven" systems of technology-related assistance, placing emphasis upon the needs of individuals as opposed to agencies and bureaucracies which have historically functioned to perpetuate themselves. The focus of the individual and the family in the implementation of P. L. 99-457 additionally suggests a need for less centralized service delivery systems that can adequately meet the needs of all young children with disabilities. Thus, it is difficult to imagine how the centralization of services for this population would adequately meet their needs, especially in rural areas where services are generally fragmented or nonexistent. Support for decentralization of services can be seen in the Arkansas study data wherein it was reported for a majority of participants that travel exceeding 50-100 miles was required to receive assistive technology and services (see Figure 2). Other states have also reported a need for less centralized patterns of technology service delivery (RESNA, 1989).

Expanding the usage of existing funding options. While technology can contribute to the independence and ability to infants and young children to interact with the environment (Brinker & Lewis, 1982; Finnie, 1974), families and service providers frequently face significant financial barriers in attempting to obtain needed technology. Increased flexibility under several existing state programs and elsewhere can facilitate the ready availability of devices and services, without forcing children into programs that are inappropriate to meet their needs.

In the initial examination of the Arkansas study data, there appeared to be an inadequate number of providers of technology services. Medicaid was the most

frequently employed funding source for assistive technology, though the criteria of "medical necessity" to receive technology services under Medicaid is very limited, particularly in Arkansas (Markowicz & Reeb, 1989). Typically, only limited technologies in the areas of ambulatory aids, mobility aids, bedroom aids, and sensory and communication aids can be purchased through the Medicaid system, though considerable variations exist across the country.

Examination of the various state proposals funded under P. L. 100-407 (RESNA, 1989) indicates that many states express a need for Medicaid buy-in insurance options for persons with disabilities who have no or limited health insurance coverage. This would allow families of young children with disabilities to purchase Medicaid coverage regardless of whether they are Medicare eligible and/or Medicaid eligible. Fees under such a framework would be on a sliding scale according to family income (Hofmann, 1990; RESNA, 1989).

There is also an expressed need for Medicaid to provide optional services across the states through the expansion of its definition of durable medical equipment. However, the Medicaid system must also help the states differentiate between what a 'medical necessity' and a convenience is--important concepts in decisions made regarding funding for assistive devices under Medicaid regulations.

In the Arkansas study it was found that the families of infants and young children with disabilities were the second most frequent source of funding for technology reported. This supports the reports of other states (RESNA, 1989) that there is an additional need for statewide training programs for individuals and families on how to access the Medicaid system.

Examination of the Arkansas survey results relating to purchasing practices for assistive devices/services indicated that over half of the families of infants and young children with disabilities did not have access to some type of credit or time payment program. This need has been reported in some states around the country

(Mendelsohn, 1989; Office of Technology Assessment, 1982), and for this sample of children, 22% of the participants in the study reported that such an alternative would be helpful. Subsequent to an earlier report by the Office of Technology Assessment (1982), numerous strategies at varying levels have been demonstrated to address the needs of persons with disabilities for credit-based funding systems. Examples are evident at the state level in the direct loan model established under the New York State Equipment Loan Fund for the Disabled and California's Handicapped Transportation and Supported Employment Loan Guarantee Programs (Mendelsohn, 1989). At the private sector and nonprofit agency level alternatives are being developed across the country in this regard, each being developed with the rationale that with good planning, persons with disabilities are good risks for loans and credit purchases. From a human potential perspective, it makes common sense to invest in technologies for any child early in life, particularly when they would optimize later functioning and diminish resource allocations necessary for the person in adulthood (Barnett, 1988).

Hands-on experiences prior to payment. Coinciding with the aforementioned finding in the Arkansas study was the report that 40% of the total respondents were unable to try out their technology before paying for it. Persons who are nondisabled in our free enterprise system are generally accustomed to being allowed a hands-on experience with goods that they wish to purchase. They are allowed to drive new automobiles, try on clothes, and listen to stereos in their homes on a trial basis; all are examples of ways opportunities afforded persons who have no disabilities. Generally, most people take this practice for granted and are unaware of the fact that persons with disabilities more often than not do not have the same freedoms. As a result, they must rely on the judgments of the professionals involved in selecting the technologies for them. The opportunity for infants and young children to try out a particular technology before they, or funding agencies, make a

financial investment in it is considerably important in view of the current practice of requiring full payment before an assistive device is ordered (Pfrommer, 1984).

Many times, the technologies are selected primarily because they are familiar to the professional, or because competing interests are existent, *e.g.*, the professional is a consultant for a company/vendor of the technology. In other instances, technologies may be selected solely due to fiscal considerations. In either instance, inappropriate technologies may be acquired for the child with a disability (Cavalier, 1989; Office of Technology Assessment, 1982; Pfrommer, 1984).

Given the relatively recent recognition by the federal government of the importance of early childhood special education programming, as well as the impetus towards the provision of a wide range of rehabilitation services to all persons with disabilities, it seems reasonable to assume that, for a time, a significant number of professionals in service delivery systems across the country will be ill-prepared to make informed decisions about what constitutes appropriate technology for many infants and young children they will be encountering. This presents an added challenge to institutions of higher education who are charged with the responsibilities of adequately training professionals who will be providing future services to this population. Similarly, an increased responsibility for more comprehensive in-service training is placed on existing service delivery systems wherein professionals are already entrenched and providing services to infants and young children with disabilities.

Transportation. The area in which reported satisfaction in the Arkansas study appeared to be the most deficient was that of transportation, as it was reported for 60% of the infants and young children that they did not have such services provided to them. Given that 67% of the respondents indicated having an evaluation prior to receipt of their assistive technology (see Table 2), it must be speculated that transportation is being provided by family members to the sites where evaluations are

conducted or they are conducted in the home settings by service providers. This is supported by the report for of 36% of the respondents that family members were paying for the assistive devices and services used by infants and young children in the sample.

Transportation admittedly is a crucial service for persons with disabilities, particularly in states that have a rural nature such as Arkansas where there is a tendency to centralize resources in the larger metropolitan areas. Without transportation to services which are geographically centralized, consumers may be systematically denied necessary technology and related services that can enhance the quality of their lives (Governor's Task Force on Technology and Disabilities, 1987; RESNA, 1989).

In the process of compiling information for the Arkansas grant application, a cooperative agreement was initiated with the Arkansas Highway and Transportation Department (AHTD). This state agency was preparing to develop its own 5-year transportation plan and subcontracted data collection methodologies with the Technology Access for Arkansans (TAARK) project. Several questions were included in the TAARK survey instrument which would assist AHTD in compiling needed information relating to the transportation needs of persons with disabilities of all ages in the state. AHTD, in turn, subsidized a significant portion of the statewide needs survey and data anlaysis used for the P. L. 100-407 grant application. A formal report was then compiled and made available for public dissemination (VanBiervliet & Parette, 1991). This reflected a unique collaborative relationship that could serve as a model for other states wishing to maximize the use of existing resources through the coordination of planning with other state agencies.

Implications for Teachers

Teachers and Early Intervention professionals need to be prepared for changing roles concerning the assessment, planning, acquisition, and use of assistive

technologies for students with disabilities. These roles may range from serving on a multidisciplinaty assessment and planning team to assisting in securing the funds neccesary to purchase assistive technology. As a result, a variety of ethical issues may arise concerning assistive technologies which practitioners will need to recognize and assist in addressing.

Ethical Considerations

Like all areas of human endeavor, the use of technology in classroom and early intervention settings must be guided by values and philosophies (Cavalier, 1986; Weinrich & Gerstein, 1987). Efforts must be made to select and apply technology in a manner that acknowledges and promotes individual dignity and the opportunity for personal choice (Cavalier, 1988; Guess, Benson, & Siegel-Causey, 1985; Pfrommer, 1984). Some of the most important ethical considerations which the teacher or early intervention professional should be aware of prior to becoming involved in the identification or adaptation of technologies for young children with disabilities are listed below (see Figure 3).

Insert Figure 3 about here

Maintaining a child focus. During the process of identifying the child's needs, developing a plan, and securing funding for assistive technology, there is a tendency to let the interesting technology become the focus of attention rather than the child and his or her educational needs. For example, a talking computer with a colorful display could capture the attention of team members and be recommended for use even if a less sophisticated approach might be more effective. Technology is *not* an end in itself; it is a means to provide increased experiences, opportunities, and independence for children who have disabilities. When used in educational and early intervention settings, technology should generally bring about changes in

behavior of the child and have observable and social validity (Evans & Meyer, 1985; Snell & Browder, 1986).

Limited knowledge of the technology. Given the many types of technology which are available, it is difficult, if not impossible, for any one person to remain informed of all new technological developments which might potentially be appropriate for a child. Herein lies the danger of the child receiving technology that a professional is familiar with, which may not be the best technology to meet the child's needs. It is crucial to ensure that all reasonable technology options are explored before an approach is recommended. Since there are a large number of human and environmental factors which affect technology selection and usage, coupled with the wide range of assistive technologies available, it is very important to optimize the use of a multidisciplinary team. The strengths and weaknesses of each discipline's knowledge base can be balanced such that the most effective educational or early intervention solution will be developed.

Educational relevance. Though attitudes toward technology are changing, educators and early intervention professionals may view a particular kind of technology as a means of "pacifying" a child (Childers & Podemski, 1984; Griffin, Gillis, & Brown, 1986). The use of computers are an excellent example, as many times they are not incorporated into the curriculum of the child, but rather they are intended merely to keep the child occupied. The same rigorous standards of educational appropriateness applied to other strategies and materials must be applied to the use of assistive technologies. One trap to avoid, involves the recommendation of an assistive device that does little to promote long term increased independence. For example, encouraging the use of a wheelchair because it makes it easier to transport a child, rather than teaching the child to use a walker or other support device. Extended use of a wheelchair will result in atrophy of the leg muscles thereby

perhaps preventing the child from learning less restrictive means of mobility in the future.

Self-perception and the perception of others. There has been a tendency in our society to focus on children's disabilities rather than their abilities, thus contributing to the belief that these children are abnormal or deviant and have less worth than able-bodied persons. It is crucial that assistive technologies do not unnecessarily draw attention to disabilities, but rather assist the child to more fully participate in the mainsteam. In some instances, this will mean selecting an assistive technology that will be most accepted in the child's environment, rather than the technology that best performs the task. For example, a head pointer (i.e., a rod attached to a headband or helmet) might be technically the best approach for a child to access a computer keyboard; however, it makes the student look very odd and might subject the student to ridicule. An approach using a keyguard, touch screen, light pen, or scanner could serve a similar pupose and be accepted more readily by peers, family, and the public.

Dignity of choice. Children and their parents have a right and a responsibility to actively participate in the educational planning process. With regard to assistive technologies, there is a tendency to think that only specialists have the necessary knowledge and experiences to make decisions about which approach to use. If this assumption operates, inappropriate technology may sometimes be prescribed, particularly when the desires of the child and family are not taken into consideration. The child and family possess unique expertise concerning their activities, goals and the environments in which they live. Failure to access this expertise could very likely result in the failure of the educational plan. For example, the failure to provide the child and his or her family the opportunity to choose the "voice" characteristics of a communication system may result in the child refusing to independently use the device. In addition, ignoring child and parental desires, or failing to even ask them

questions, conveys the message that they do not matter in the educational process. Participation in the decision process does not mean presenting the child and parent with a plan and asking for their consent; rather, it means sharing assessment information and information about the strengths and weaknesses of all the alternatives, and then encouraging and facilitating them to actively participate in the creation of a plan.

Charity. Historically, children with disabilities have been viewed as being the responsibility of society. Even in more recent times, many persons continue to believe that these children are a burden of public charity (Wolfensberger, 1969). Hence, an attitude has evolved that these children should be grateful for the charity they receive; any technology which is then prescribed is viewed as being better than nothing. This may result in the use, or attempted use, of a technology because it was available (e.g., donated by a local vendor) not because it was appropriate for the child's needs and educational goals. Decisions regarding assistive technologies should be primarily based on the child's need for that technolgy in order to participate in an appropriate educational program.

Limitations imposed on the technology. Unfortunately, many technologies which are acquired for children with disabilities are viewed first and foremost as property of the school, as opposed to technology which increases the independence and functioning of the child *across environments*. Augmentative communication systems are an excellent example, in that frequently a school system will purchase such a technology only for use in the classroom setting. Little thought is given to the child's communication needs when he or she leaves the school setting. Limiting a child's access to assistive technologies that are crucial to functioning across environments will severely limit learning opportunities and even disrupt learning at school. The teacher or early intervention professional must consider the child's total

needs when developing and implementing educational plans involving assistive technology.

Individual rights and social equity. Problems in the full funding of 94-142, P.L. 99-457 and other educational initiatives, may result in administrators being reluctant to embrace the idea of providing expensive technologies to students with disabilities (Mendelsohn, 1989). Teachers and early intervention professionals must remember that there are limited resources with which programs have to operate, and there is a prevailing concern that those resources be used in an efficient manner. This implies the need to examine a range of technologies which might be appropriate for a particular child, and to give the cost factor careful consideration. The most expensive technologies are not always the best ones to meets the needs of children with disabilities. Frequently, the most appropriate choice is a low-tech solution that requires little training to use and minimal maintenance. It is crucial to remember, however, that the assistive technologies must be appropriate for meeting the child's educational or early intervention goals.

A Challenge to the Schools

In the future, devices and equipment will become more attainable as the costs of producing them decline (Esposito & Campbell, 1987). With decreases in the costs associated with technologies which can help children to benefit from special education, it may be anticipated that a wider variety of devices and equipment will be provided with greater frequency. Already, many schools have acknowledged a willingness to invest in more sophisticated technologies, such as computers for children with special needs (Bennett & Maher, 1984; Officer of Technology Assessment, 1988). Since information about and training in the use of the many different types of technologies used in school settings is an often cited need for teachers and early intervention professionals (Office of Technology Assessment, 1988; RESNA, 1989), professionals will increasingly be encouraged to acquire more

information about devices and assume more skills in technology service provision. As these skills are acquired they must, in turn, be used to assist in the selection and use of equipment in service settings. Important meetings where professionals may obtain information and acquire skills are indicated in Table 3. A listing of the various journals which publish information pertaining to technology and its applications for children with disabilities may be requested by calling the Council for Exceptional Children Technology Center (1-800-873-8255).

Insert Table 3 about here

A team approach. Within the public schools and early intervention settings, the design and application of adaptations and technological devices is usually accomplished through a multidisciplinary IEP or IFSP team of professionals and other interested parties. This will include occupational, physical, and speech/language therapists; special and regular education teachers; early intervention professionals, and parents. Part of the assignment of the team is to assure that all dimensions of the child's present levels of performance are considered. This team approach is most effective when persons having expertise in instructional programming, including technology and its applications, work cooperatively with parents and professionals who are involved in day-to-day instruction of children.

Practitioners who participate in such team processes may be called upon to assume important responsibilities as team members. Unfortunately, many professionals to date have had inadequate training and/or experience with technology and its applications. When they are not prepared for the responsibility of selecting devices for children and using them in service settings, they may rely too heavily on the judgment of other professionals (e.g., the occupational, physical, or speech/language therapist). These professionals may see the child and his/her needs

from a very different (and more limited) perspective than does the teacher or early intervention professional.

Selection of Appropriate Technology

It is important for the teacher or early intervention professional, as well as all other team members, to develop a philosophical base around which decisions will be made when selecting appropriate technology for children with disabilities. It is also important to remember that "appropriateness" takes on several dimensions. P.L. 99-457 was defined to encompass any need the child and family has related to learning and/or development, including the need to learn basic self-help skills, to have appropriate adaptive equipment, to develop appropriate social interaction skills, and to receive therapy services. In each of these areas, devices and equipment can play critical roles in assuring the provision of appropriate learning experiences for children with disabilities in school settings and early intervention settings.

From a more traditional perspective, a technology is appropriate when its application meets one of three criteria. First, it should be in response to (or in anticipation of) specific and clearly defined goals which result in enhanced skills for the child. Second, it should be compatible with practical constraints such as the available resources or amount of training required for the child and the professional to use the technology. Third, it should result in desirable and sufficient outcomes (Office of Technology Assessment, 1982)(See Figure 4).

Insert Figure 4 about here

Determining the Fit

To most effectively match technology with any given child, the professional and other team members must keep in mind two parallel considerations: characteristics of the child, and characteristics of the technology.

Child characteristics. The characteristics of the child are of the utmost importance, and must be considered first (see Figure 5). The comprehensive

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Insert Figure 5 about here.

assessment procedures which determine the present levels of functioning and precede the actual program development process provide the initial basis for any devices or equipment. In addition to the obvious selection implications of such child characteristics as academic skills, intellectual level, behavioral and social skills, and physical abilities, the professional and other team members must consider child preferences for certain types of technology. An assistive device which on paper appears excellent but remains unused by the child because he or she is uncomfortable with it is the equivalent of no assistance at all.

Since the development of the IFSP and IEP is a joint effort of a team, child preferences will be exhibited during the decision-making processes if the child is allowed to express his or her preferences. Interviews with the parent and child can yield significant information not otherwise attainable. For example, a girl may be most uncomfortable using an augmentative communication system which uses a male adult voice. Alternatively, the IFSP or IEP team may wish to determine which devices and equipment the child has had successful previous experiences with at school or at home. Once this information is acquired, the team may wish to purchase a similar technology for for use in the school setting with appropriate modifications being made to meet the needs of the child. As an example, a particular type of adaptive spoon may have been highly effective for the child to feed him/herself at home. The same type of spoon should be given consideration by the IFSP or IEP team to assist the child with his or her self-help skill development at school if this is deemed to be an important area of concern.

Additional considerations include anticipating the child's needs in the future, vocationally and otherwise. This becomes important with older students who are entering transition programs. For example, an older student with physical disabilities who has significant academic strengths may be a potential candidate to receive a modified computer system with adapted input and/or output modes. The IEP team may feel that development of computer skills may facilitate the student's entry into possible careers with a telecommunications firm such as IT & T, or business corporation such as IBM, both of which employ persons with disabilities in their workforce. Many government agencies, such as the IRS, also employ significant numbers of persons with disabilities.

Given the concern that all service systems have for the equitable distribution of resources, cooperative arrangements for the funding of the technology may sometimes become an alternative for IFSP or IEP team consideration if a child is to receive a needed technology. Alternative financial avenues include the use of the Medicaid program and private insurance. Teachers and early intervention professionals must bear in mind the argument that any device identified and recommended by the IEP Committee should be paid for with public funds. For IFSPs, other payers will be identified, including private insurance and Medicaid. In practicality it must be recognized that not all equipment which can be of benefit to children can be subsidized by a single provider. Space-age technology is available through the National Aeronautics and Space Administration (NASA) (1988) that has limitless possibilities for technology applications for persons with disabilities. These technologies, such as robotics and artificial intelligence devices, are not yet commercially available on a wide scale basis and their expense would be impossible for most school systems to consider for all children with disabilities. In such cases where costly, commercially unavailable technology is deemed to be a desirable alternative for a child with a disability, the IEP team may choose to find partial

external funding for the device. This may enable the school to provide a specific technology that would not otherwise be possible.

Technology characteristics. Once relevant characteristics of the child have been identified and considered, the characteristics of the various technologies that will be considered for the child may be focused on (see Figure 6). Goals for the use of devices

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Insert Figure 6 about here.

should emerge as a result of the assessment of the needs, desires, and capabilities of the child. In examining the range of technologies which might be useful for the child with a disability, a variety of factors should be carefully considered.

The availability of the equipment is of crucial importance. Sometimes technologies are not in stock by vendors of the technology, and/or require lengthy periods of time to manufacture. This is particularly true of small firms which market a product that has a large demand, such as the ADAMLAB Wolf and ScanWolf augmentative communication devices. These products are manufactured by the Wayne County Intermediate School District (undated), in Wayne, Michigan, and are pre-programmed communication devices that are modestly priced. They are in great demand due to the low cost and ease of use by children and professionals. However, delivery of this equipment can take up to two months once an order has been placed. It must also be remembered that most commercially available equipment cannot be modified by a manufacurer to meet the unique needs of a child with disabilities. Generally, devices must be customized or modified by others once the technology has been purchased for the child. This may require significant amounts of both time and money to accomplish.

The simplicity of operation of the equipment is an important area of consideration. Too often schools purchase technologies that are overly complex and require tremendous training investments of teachers and the children who are

recipients of the equipment. When devices require large amounts of teacher time in order to learn to operate and maintain them, most teachers will be understandably reluctant to learn to use the technologies. As a result, the devices often are relegated to a storage closet in the school and is seldom used. One example of a frequently purchased technology that is quite complex to use is the Touch Talker (Prentke Romich, 1990). This sophisticated speech device can be used with a keyboard having 8, 32, or 128 keys. It can compose messages or be programmed by the child, teacher, or parents to use up to 1,200 messages. For children with higher cognitive abilities having experience in using a wide range of speech, use of the Touch Talker will require a great amount to program the device to accomodate the child's speech usage needs.

The initial and ongoing costs of the technology is one of the most frequent concerns expressed by school personnel at the administrative level, and is certainly a significant factor (Cavalier, 1989; Office of Technology Assessment, 1982). Installation costs (if any) must be considered, as this sometimes additional and costly expense may not be reflected in the price quote provided to the IEP team by the vendor. The cost of daily, monthly, or annual operation must be given consideration. Some devices, particularly those which require power packs or batteries, may require frequent and unanticipated replacement expenses. Augmentative communication devices and power wheelchairs are two types of devices that will require ongoing and regular replacement expenses for batteries. Other equipment may require periodic maintenance and associated costs.

Since many technologies will be used for a long period of time, adaptability to meet the changing needs of children over time must be carefully considered. For example, a communication device which can be modified over time to continue to meet the evolving needs of a child with a disability would be more desirable than a device which could only be used one year. The Light Talker (Prentke Romich, 1989) is

an example of a sophisticated communication device that can be used for many years with a variety of hand-controlled switches. For children with physical disabilities, the type of switch used to control this device can be changed as the child's physical condition changes over time. If the child's condition deteriorates such that he or she becomes unable to use their hands to manipulate a switch, an optical light pointer can be used that enables the child to use head movements to activate and control the device.

Another important consideration in the selection of technologies is the reliability and repair record of the devices. Some technologies, or certain brands or models of those technologies, require lengthy or frequent repair intervals. In fact, most augmentative communication boards and power wheelchairs require ongoing repair. Since communication boards are used frequently throughout the course of a day's activities, they become worn, soiled, and damaged. Children who sit in wheelchairs daily will cause wear and damge to the seats, armrests, and other padded surfaces of the equipment. In either case, once the technology is removed from the child to be repaired, the child is denied access to a device that enhances his or her quality of life.

Teachers and other members of the IEP team may ask representatives of companies that sell certain types of equipment about the reliability and repair records of devices. Sometimes there may be product testing information regarding specific technologies that is available to the IEP team on request that would provide the needed information. However, the best information about device reliability is probably obtainable from children who use the devices. In Arkansas, for example, a User-to-User network will be developed in the state technology system that has been funded under P.L. 100-407 (Arkansas Division of Rehabilitation Services, 1989). This system will be patterned after the Parent-to-Parent network established by the Association for Retarded Citizens in many states. Basically, such a network is made

up of volunteers who agree to act as contact persons within the system for anyone wishing to get information about a particular type of technology. Thus, a teacher or anyone considering buying a specific device for a child with a disability can get the personal experiences of a person who has used the technology. In states where such a network is not being developed, teachers may contact local advocacy groups and attempt to identify a person or people who are using certain technologies. These persons may then be contacted and questioned about the reliability of the equipment of concern to them.

Finally, the teacher must examine the ability of the technology to provide performance or evaluation data necessary for the documentation of student progress. Certain technologies, especially computer-based devices, readily lend themselves to objective, behavioral record-keeping strategies. A computer spelling program which maintains an ongoing count of the number of lessons a child had completed and the accuracy of those performances lends itself more readily to record-keeping for IEP and other purposes than would an instructional program which required the direct observation of the teacher.

Specific Suggestions

As a teacher or early intervention professional, a critical role is assumed in meeting the needs of children with disabilities and their families. In light of the increasing importance of technology in our society, and the recognition of the roles professionals must assume in the evaluation, planning, and implementation of assistive technologies for children with disabilities, some specific observations are in order:

1. Children with disabilities respond best to technological interventions when they receive support from their peers in the school environment. This suggests the importance of employing a peer approach for intervention (Belkin, 1981; Parette & Hourcade, 1984). Peer counseling strategies may be used wherein children in the

regular classroom or early intervention setting are given information about technologies which children with disabilities may be using. Cooperative school activities may also be suggested to other professionals to facilitate the integration and acceptance of the child with a disability.

2...Since a desirable goal of the educational process for all children is continuity of programming, technologies which are selected for children with disabilities should facilitate the transfer of skills across environments and time. Parents or primary care givers must be involved in the educational process in order to ensure continuity of programming. The teacher or early intervention professional may be required to provide information about technologies to parents, or to assist in the resolution of family problems which develop as a result of the processes of technology selection, payment, or use.

3...Parents may be struggling with issues of acceptance of their child who has a disability, and view them as being more different than like other children. The prescription of technologies might potentially exacerbate these feelings, suggesting the need for the teacher or early intervention professional to cultivate more realistic and optimistic expectations. Reporting the child's success in using technology in the school environment might be an important strategy for eliciting more positive parental feelings toward their child and the technology they are using.

4...Parents may come to expect that once an appropriate technology is selected for their child with a disability, that their child will be "normal". It cannot be ignored that attitudes of other children, and society in general, though changing, are still relatively negative toward persons with disabilities. Barriers which inhibit full interactions with and access to the environment are readily apparent. Elevators are not present in many buildings, ramps are often unavailable, and public bathrooms are yet to be universally accessible. These and many other problems will have an affect upon the child, and may contribute to the development of emotional problems in the

child and/or family. The teacher or early intervention professional should be aware of the potential impact of these obstacles and provide information as to how the child's technology can overcome such hurdles.

5. Conversely, technologies may function as a form of emotional support to families. They can reduce the amount of time that parents may have to spend performing tasks for their children, thereby reducing stress in the family unit and decreasing the need for crises counseling or other counseling strategies.

Conclusion

As the provision of technology and technology-related services to children in service settings becomes a more frequent and prominent activity, teachers or early intervention professionals will increasingly be called upon to participate in the processes needed to ensure the success of assistive technologies. It is important to remember that technology itself is not going to change anything; only when it is integrated into the assessment and selection processes will real changes occur in the lives of children with disabilities who need it. Bearing these factors in mind, the teacher or early intervention professional can become a crucial factor in optimizing the educational experiences of children who have disabilities by giving careful consideration to the issues and competencies described herein.

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Table 1

Areas of Assistive Devices/Services Used and Areas of Unmet Needs as Reported for Young Children with Disabilities, Ages 0-5

Area	*n* Use	%*	*n* Unmet Need	%*
Recreation	73	.60	49	.40
Getting Around	66	.59	46	.41
Self-Help	69	.55	57	.45
Specialized Seating	50	.51	48	.49
School Training	52	.50	52	.50
Artificial Limbs, Braces, & Prostheses	38	.50	38	.50
Hearing Aids & Other Hearing Devices	36	.49	37	.51
Talking with Others	36	.39	56	.61
Things That Help You See	25	.30	58	.60
Specialized Cars, Vans, & Buses	29	.30	67	.60
Reading, Writing, & Typing	18	.27	49	.73
Taking Care of Home	13	.25	39	.75
Building Accessibility	18	.22	63	.78
Using a Telephone	11	.17	49	.83
Using a Computer	11	.12	81	.88

* Reflects percentage of total number of parents/guardians responding to a particular Area item (Column 1).

Table 2

Reports of Satisfaction with Technology Services Provided to Young Children with Disabilities, Ages 0-5

Survey Question	*n* Yes	%*	*n* No	%*
Were you given an evaluation before getting your assistive device?	138	.83	27	.17
Are you satisfied with the services you receive for assistive devices you use?	139	.83	27	.17
Did you have the opportunity to buy assistive devices/services on a "buy-on-time", or credit plan?	29	.20	116	.80
If not, would a "buy-on-time", or credit plan help?	80	.63	46	.37
Have you received enough training in the use and care of your assistive device?	82	.63	49	.37
Were you able to try out the device before paying for it?	51	.38	82	.62
Are you satisfied with the time it takes to repair/service your device?	61	.60	40	.40
Do you need more information about assistive devices/services that could help you?	119	.69	53	.31

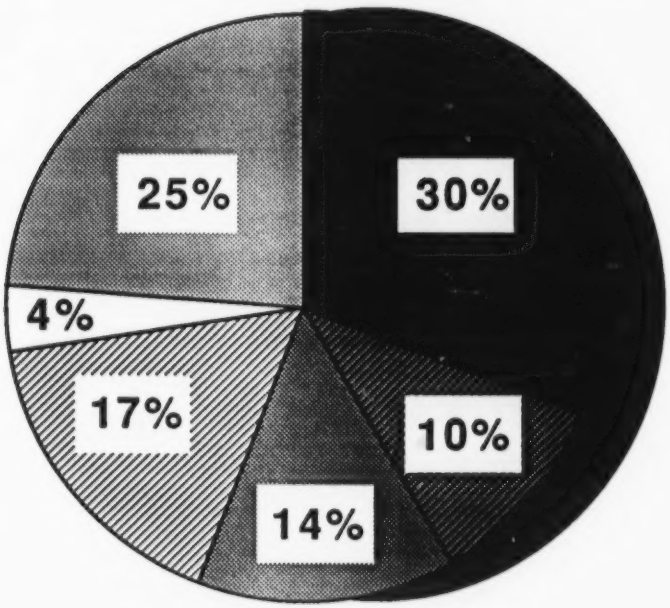
* Reflects percentage of respondent class, *i.e.*, the total number of respondents answering a particular Survey Question (Column 1).

Table 3

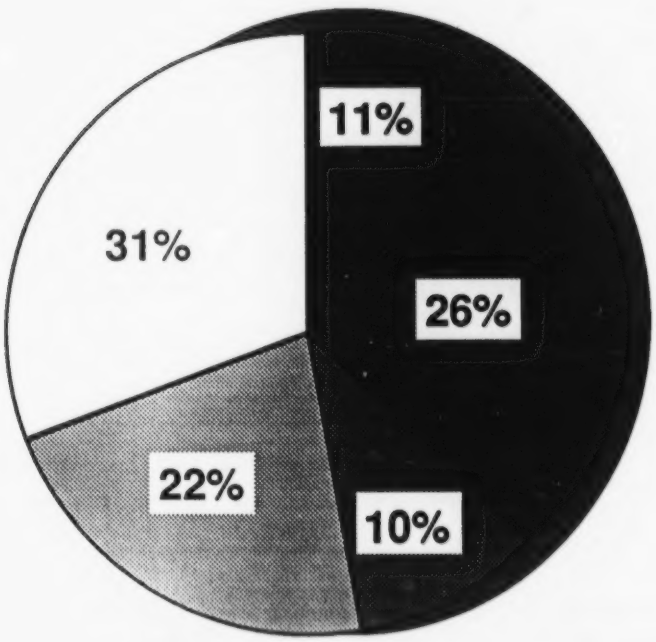
Listing of Important Technology Conferences

Conference	Date	Attendance	Target Audience
International Technology and Media (TAM) Conference	Winter	375-400	Educators
Closing the Gap	Fall	1200	Mixed
Touch the Future	Fall	250-300	Mixed
Technology and Persons with Disabilities	Spring	2000	Mixed
ConnSENSE	Summer	200 or more	Mixed

Reported Expenditures for Assistive Technology in 1988 for Young Children with Disabilities, Ages birth - 5 Years



Travel Required for Young Children to Receive Assistive Technology



Considerations in Selecting Appropriate Technology

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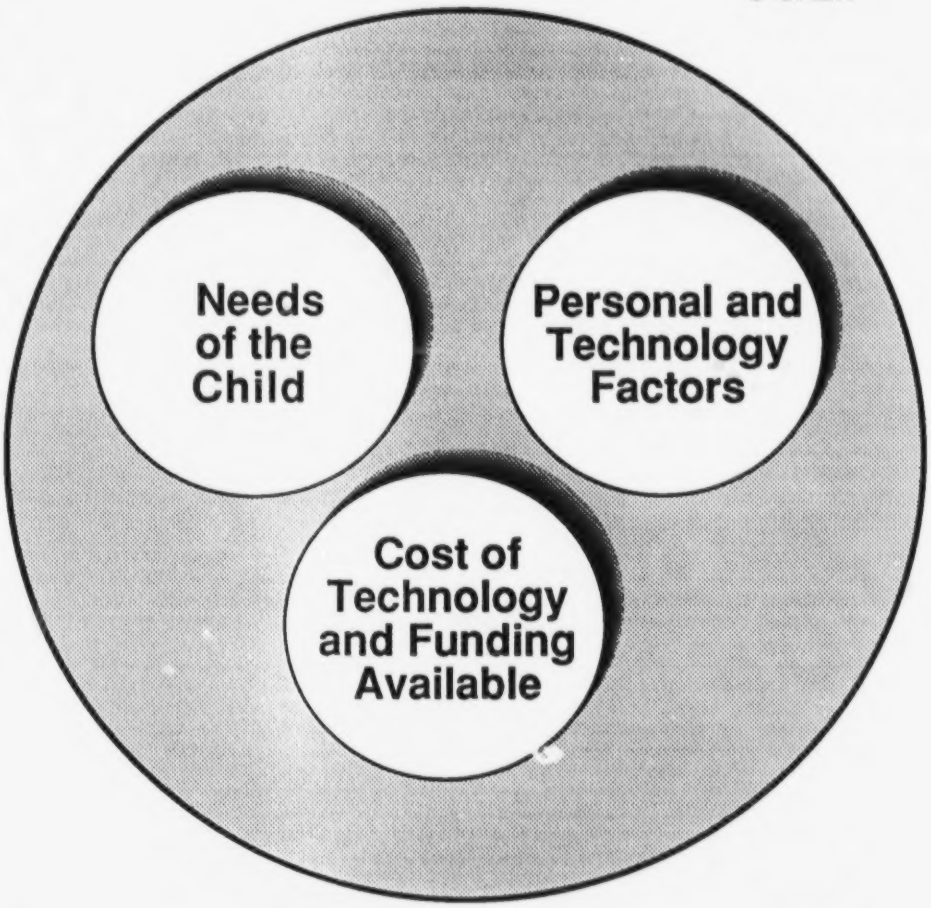

Source: Parette, H. P., & VanBiervliet, A. (1990). ***Assistive Technology Curriculum for Arkansans with Disabilities.*** Little Rock, AR: University of Arkansas.

Personal Factors in Selecting Appropriate Technology

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- Consumer skills
- Consumer needs
- Consumer preferences
- Age and sex of consumer
- Home and family activities
- Location of services
- Consumer goals

Source: Parette, H. P., & VanBiervliet, A. (1990). ***Assistive Technology Curriculum for Arkansans with Disabilities.*** Little Rock, AR: University of Arkansas.

Technology Factors in Selecting Appropriate Devices and Equipment

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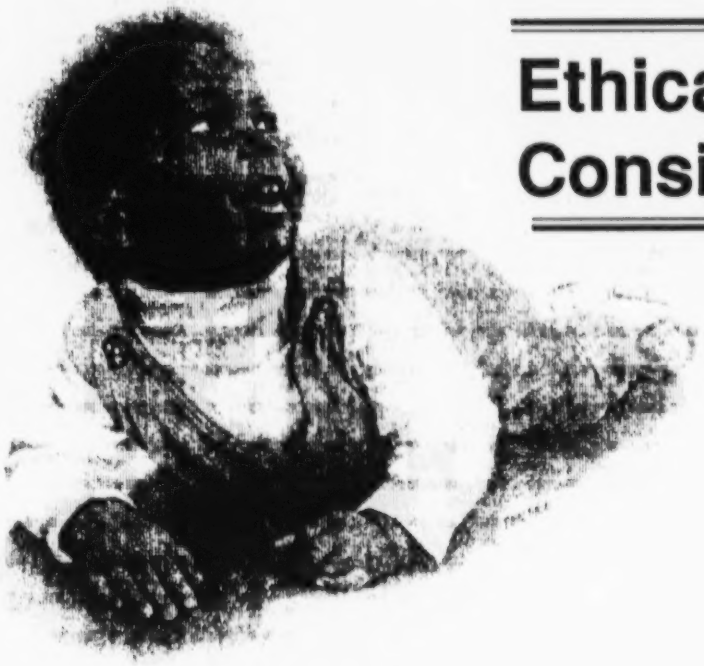
- Range of technology
- Real cost of the technology
- Consumer ability to use the technology
- Dependability of the technology
- Ability to move the technology
- Lifespan of the technology
- Usefulness with other devices
- Trying the technology
- Day to day maintenance
- Safe from injury
- Protection from theft and damage
- Comfort of the technology
- Ease of repair

Source: Parette, H. P., & VanBiervliet, A. (1990). ***Assistive Technology Curriculum for Arkansans with Disabilities.*** Little Rock, AR: University of Arkansas.



Ethical Considerations

- Maintaining a child focus
- Limited knowledge of the technology
- Educational or family relevance
- Self-perception and perceptions of others
- Dignity of choice
- Charity
- Limitations imposed on the technology
- Individual rights and social equity